



INCORPORATING WAYNE KERR INSTRUMENTS

Racal Medical Ltd.
Test Equipment Maintenance Department

Location: -

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ID 1224

Instruction/Service Manual for

P SERIES GPIB CARD

Part No. 9HPBUS

MP MASTER



MA23428

FARNELL INSTRUMENTS LIMITED, SANDBECK WAY, WETHERBY, WEST YORKSHIRE LS22 4DH, UK

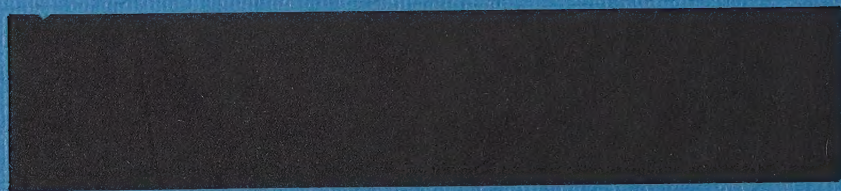
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SAFETY

GENERAL

This equipment has been designed to meet the requirements of IEC publication 348, "Safety Requirements for Electronic Measuring Apparatus", and has left the factory in a safe condition.

The remainder of this section on safety provides information and warnings which must be followed by the user to ensure safe operation and maintain the equipment in a safe condition.

A.C. POWER SUPPLY

1) If it is necessary to fit a suitable a.c. power plug to the power cable, the user must observe the following colour codes:

LIVE terminal to BROWN lead

NEUTRAL terminal to BLUE lead

EARTH terminal to GREEN/YELLOW lead.

The user must also ensure that the protective earth lead would be the last to break should the cable be subject to excessive strain.

2) If the power cable electrical connection to the a.c. power plug is through screw terminals then, to ensure reliable connections, any solder tinning of the cable wires must be removed before fitting the plug.

3) **WARNING!** Any interruption of the protective earth conductor inside or outside the equipment or disconnection of the protective earth terminal is likely to make the equipment dangerous. Intentional interruption is prohibited.

4) Before switching on the equipment, ensure that it is set to the voltage of the local a.c. power supply.

ADJUSTMENT, REPLACEMENT OF PARTS, MAINTENANCE AND REPAIR

1) When the equipment is connected to the local a.c. power supply internal terminals may be live and the opening of the covers or removal of parts (except those to which access can be gained by hand) is likely to expose live parts. The equipment must be disconnected from all voltage sources before it is opened for any adjustments, replacement maintenance or repair.

2) Capacitors inside the equipment may still be charged even if the equipment has been disconnected from all voltage sources.

3) Any adjustment, maintenance and repair of the opened equipment under voltage must be carried out by a skilled person who is aware of the hazards involved.

4) Ensure that only fuses with the required rated current and of the specified type are used for replacement. The use of makeshift fuses and short circuiting of fuse holders is prohibited.

STATIC ELECTRICITY

The unit supplied may use static devices and service personnel should be alerted to components which require handling precautions to avoid damage by static electrical discharge.

Before handling circuit board assemblies containing these components, personnel should observe the following precautions:

- 1) The work surface should be a conductive grounded mat.
- 2) Soldering irons must be grounded and tools must be in contact with a conductive surface to ground when not in use.
- 3) Any person handling static sensitive parts must wear a wrist strap which provides a leaky path to ground, impedance not greater than 1 megaohm.
- 4) Components or circuit board assemblies must be stored in or on conductive foam or mat while work is in progress.
- 5) New components should be kept in the suppliers packaging until required for use.

DISPOSAL HAZARDS

Service personnel should be aware of the following:

- 1) Cathode ray tubes can implode if subject to excessive mechanical shock.
- 2) Batteries should be disposed of intact and never incinerated.
- 3) Beryllium oxide washers must be disposed of intact as toxic waste.
- 4) Many components contain polymers which will give rise to toxic fumes if incinerated.

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1. SPECIFICATIONS

The following specifications apply at 23° C ambient:-

1.1 Programming Resolution & Maximum Values

This is dependent upon the unit to which the interface board is fitted, but always corresponds to 11sb (1 least significant bit) of the programming DAC.

See table 1 below:-

Model	VOLTAGE	Max V	CURRENT	Max I
PDD3010	10mV	32.00V	2.5mA	10.237A
PDD6005	20mV	64.00V	1.25mA	5.118A
PSD3510	10mV	38.00V	2.5mA	10.237A

Table 1 - Programming Information

The programming resolution above applies to both the output voltage and the over-voltage trip.

1.2 Programming Accuracy

The output of the P unit may be programmed with the following accuracies:-

VOLTAGE: 0.2% of the output + 0.2 % of full scale

CURRENT: 1.1% of the output + 0.2 % of full scale

OVER-VOLTAGE TRIP: 1% of the output + 0.5V

1.3 Readback Accuracy

The output of the P unit may be monitored with the following accuracy:-

VOLTAGE: 0.2% of output $\pm$ 0.16% of full scale

CURRENT: 1.1% of output $\pm$ 0.16% of full scale

1.4 Isolation

The GPIB interface is opto-isolated from the power supply output.

1.5 Monitoring Facilities

The P Bus interface allows the GPIB controller to monitor the following status flags:-

- i) Constant voltage mode
- ii) Constant current mode
- iii) Over power
- iv) Sink mode
- v) Over temperature trip
- vi) Over voltage trip

Note:

- i) 'Sink' mode signifies that the power supply is trying to sink current via the active bleed circuit in order to pull the output voltage down. (please refer to the power supply manual for further details.)
- ii) The presence of an 'Over power' or 'Sink' condition implies that the output is temporarily unregulated. This condition is indicated on the power supplies front panel by the 'Unreg' annunciator.
- iii) The 'Sink' and 'Over power' conditions do not apply to the linear power supply (ie the PSD3510).

1.6 Programming Speed

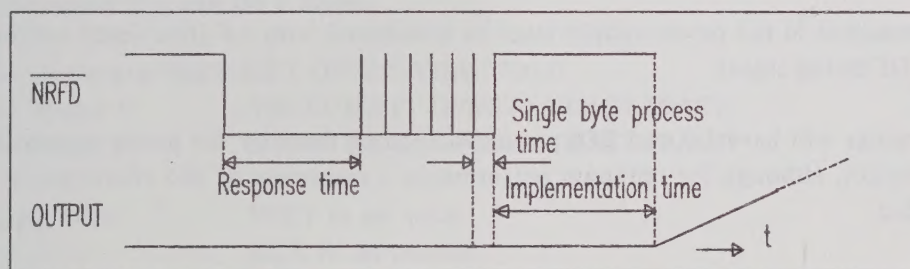


Fig 1.1 Bus Speed

Typical response time - 5mSec.

Single byte process time - < 1mSec.

Typical implementation times:

VDAC/IDAC - 18mSec

VSET/ISET - 30mSec

*RCL - 24mSec

DCL/ZERO - 14mSec

2. OPERATION

2.1 Preparation

Before switching any of the system on: set the required GPIB address for the power supply on the switches next to the GPIB connector. The address value is in binary, with the MSB to the left (looking from the rear), up is 1, i.e. representing a decimal value of 16 for the MSB.

The rightmost switch is not used for the address value, this changes local lockout mode. (See Section 2.3).

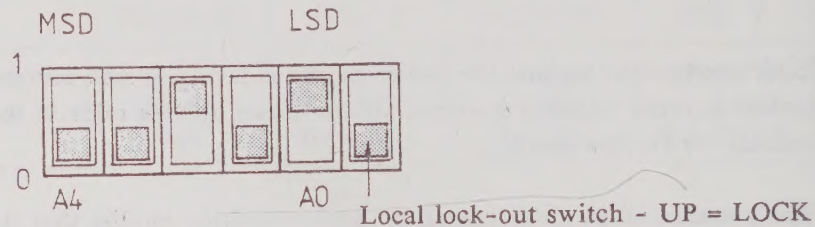


Fig 2.1 Address Switches

Note: the switches are read at power-up. To change the address or lock-out mode it will be necessary to turn the unit off then on again.

2.2 Controller Setup

To control the power supply via the IEEE bus, a suitable IEEE bus controller is required (e.g. PC plus interface card). This must be set up to transmit and receive ASCII character strings to and from the power supply using the address to which the power supply has been set.

Strings transmitted to the power supply must be terminated with LF (line feed) and/or EOI, the GPIB End Of String signal.

Received strings will have LF and EOI put on the end of them by the power supply. Strings can be of any length, although for optimum performance a maximum of 255 characters is recommended.

Note: a string will only be acted upon after the LF and/or EOI is sent.

This, and the format/syntax for all the commands that control the power supply is defined by the IEEE-488.2 standard for data transmission via the IEEE-488 GPIB system, which this instrument is designed to meet.

The following IEEE-488 interface functions have been implemented:

SH1 - Source Handshake
AH1 - Acceptor Handshake
T5 - Talker
L3 - Listener

SR1 - Service Request
RL1 - Remote/Local
DC1 - Device Clear

2.3 Remote/Local Operation

The selection of the operating mode - remote or local is determined by the following:

- i) The First Bus Transmission - In its factory default state the unit will normally switch on in local and enter bus (remote) control when the first command is sent and the remote enable (REN) line in the bus is true. To return to local press the momentary action switch to the right of the address switches (see *fig 2.1*). Alternatively set the REN line false, send the GPIB command 'LCL' or remove the GPIB connector.
- ii) The Local Lockout (LLO) GPIB command - This is a low level command on the bus that will lockout the 'Return To Local' momentary action switch. It is possible to override with the 'LCL' command. When the GPIB connector is removed from the controller or the REN line is unasserted the unit will return to local
- iii) The Local Lock-out Switch - See *fig 2.1*. This has been included as a safety feature to avoid the local controls being available even when the GPIB connector hasn't been fitted or has dropped off. When UP the unit will NOT enter local mode unless specifically unlocked by a special bus command (LCK - see 2.4.8), the 'Go To Local' button is disabled as is the standard bus command 'LCL'. When DOWN the unit behaves normally as described above.

When in remote mode the BUS flag will be asserted on the display/s.

2.4 Commands.

2.4.1 Programming V,I and OVT limits.

For single o/p VSET ISET OVSET VDAC IDAC

For output 1 VSET1 ISET1 OVSET1 VDAC1 IDAC1

For output 2 VSET2 ISET2 OVSET2 VDAC2 IDAC2

Send a string, with: VSET to set volts
 ISET to set current
 OVSET to set over-voltage trip level

followed a space, then the value, which can be in either decimal, or non-decimal numeric formats, as specified in the 488.2 standard:

/
 e.g to set 24.5 volts, any of the following would work:

VSET 24.5 or VSET .245E2 etc.

Each command must be separated by a semicolon.

e.g VSET 24.5;ISET 8

VDAC and IDAC allow the user to programme the D to A converters for voltage and current directly. This offers considerable improvements in programming speed which may be required for some demanding applications.

The DACs used by the interface are 12 bit and offer a maximum resolution of one part in 4096. However in order to provide a rational decimal programming step this resolution is slightly reduced, in other words the full scale setting on the DAC is less than 4096.

To calculate the appropriate DAC setting divide the required voltage or current by the programming resolution. This is provided in section 1.1 of this handbook supplement.

e.g to set the voltage on an PSD3510 to 33.56V :

$$\text{DAC setting} = \frac{33.56}{0.01} = 3356$$

NB: The setting is always an INTEGER. If a decimal point is sent all data after it is ignored, no rounding will be performed. Exponents will also be ignored. This is to keep the data processing simple to optimise speed.

e.g to set the voltage dac to 3356

VDAC 3356 or VDAC +3356.0

It is not possible to program values in excess of the operating maximum of the power supply - these will cause an error.

2.4.2 Enabling and Inhibiting the output.

Single	OUT OVRST ENA INH
Output 1	OUT1 OVRST1 ENA1 INH1
Output 2	OUT2 OVRST2 ENA2 INH2

Send OUT 1 to enable, OUT 0 to inhibit OR Send ENA to enable, INH to inhibit.

N.B To reset an overvoltage trip, OVT, the output has to be disabled and then re-enabled, this can be done with a single command:

OVRST

2.4.3 Stores.

*SAV *RCL

There are 110 stores each capable of holding all the settings for the power supply. Hence with one command all the parameters can be configured, i.e voltage, current, overvoltage, on/off, and Service Request Delay and enable masks, (MDEN, *SRE, *ESE). Using the stores will speed up the programming speed of the system considerably.

To store the present configuration at store location 8:

***SAV 8**

To recall from store location 8:

***RCL 8**

The stores range from 0 to 110.

2.4.4 Summary of commands

Parameter	Command	Data
Voltage Limit	VSETn	Numeric Data (volts)
Current Limit	ISETn	Numeric Data (amps)
Voltage Limit - Unscaled	VDACn	Numeric Data **
Current Limit - Unscaled	IDACn	Numeric Data **
Overvoltage Limit	OVSETn	Numeric Data (volts)
Output Enable	OUTn	1/0 (on/off)
Reset Overvoltage Trip	OVRSTn	---
Service Request Delay	DLYn	Numeric Data (seconds)
Store Settings	*SAV	Integer (store no.) **
Recall Settings	*RCL	Integer (store no.) **
Enable Service Request	*SRE	Binary Weighted (bit mask)
Event Status Enable	*ESE	Binary Weighted (bit mask)
Mode Register Enable	MDEN	Binary Weighted (bit mask)
Clear Event Status Reg.	*CLS	---
Operation Complete	*OPC	1/0 (set/unset)
Reset (Pon)	*RST	---
Wait	WAI	Numeric Data (seconds)
Clear Output Queue	QCLR	---
Go To Local	LCL	---
Bleep!	BLP	---
Device Clear	DCL	
Reset all parameters	ZERO	
Resets all stores	SCLR	

N.B ALL commands that start * have their function defined by the IEEE 488.2 standard.

**N.B For optimum speed, these parameters are integers. All data after a decimal point will be ignored no rounding will occur and any exponent will also be ignored.

n - Output number 1, 2 or no suffix for single o/p supplies.

Table 2 - Commands Summary

2.4.5 Query, or readback commands.

Query commands are sent to the power supply to specify the parameter that it is required to be. Once a query is accepted the response is placed in the output queue. This is accessed by a standard GPIB request for data and the power supply will talk. The TLK annunciator on the display will be asserted when this happens.

The accumulated contents of the queue will be returned. Up to 255 bytes of data can be accumulated for one read. An error will occur if the queue is overfilled.

The "talk" data will be terminated by a LF (line feed) character with EOI true. All the data is in ASCII.

All the settings that have been made can be read back, as well as the actual output values.

2.4.6 Summary of "talk" or "query" commands.

Parameter	Query cmd	Format of "talk" string
Voltage Setting	VSETn?	signed value NR2
Current Setting	ISETn?	signed value NR2
Unscaled Voltage	VDACn?	signed value NR1
Unscaled Current	IDACn?	signed value NR1
Output Voltage	VOUn?	signed value NR2
Output Current	IOUn?	signed value NR2
Overvoltage Setting	OVSETn?	signed value NR2
Enabled yes/no	OUTn?	signed flag (1/0) NR1
SRQ Delay value	DLYn?	signed value (seconds) NR2
Status byte	*STB?	signed binary weighted decimal NR1
Service Request Enable	*SRE?	"
Status/Mode Register	MDn?	"
Status/Mode Enable	MDEn?	"
Event Status Register	*ESR?	"
Event Status Enable	*ESE?	"
Error Register	ERR?	"
Accumulated Mode	AMDn?	"
Operation Complete	*OPC?	signed flag (1/0) NR1
Self Test	*TST?	signed binary weighted decimal NR1
Identification	*IDN?	"FARNELL,<name>,0,<ver>" STRING
Rom Date	ROM?	"dd-mm-yy" STRING

Table 3 - Query Commands

2.4.7 Power supply status, service requests (SRQ), and serial poll.

DLYn *SRE *ESE MDE *CLS *OPC

DLYn? *SRE? *STB? *ESR? *ESE? MDn? MDEn? ERR?

The operating status of the power supply, i.e what trips have operated, or what operating mode it is in, CV, CI etc. is represented by six flags which can be read as one register, the MODE register, using the MD? command. This returns a binary weighted decimal value according to the following:

B7	B6	B5	B4	B3	B2	B1	B0
--	--	OP	OT	OV	SK	CI	CV

SK - SINK Unregulated condition, active bleed ON.

OP - OVER POWER Unregulated condition, power limit exceeded.

NB Both SINK and OVER POWER conditions cannot occur on the PSD3510 linear psu.

Fig 2.2 Mode Register

The contents of this register, along with two other registers, the "Error" register and the "Event Status" register, which contain hardware error information and software status detail, can be linked with the use of three "Enable" or bit "Mask" registers to generate a Request for Service, or SRQ, interrupt signal for the GPIB controller.

Service requests provide the only means that any instrument on a GPIB system can asynchronously signal the controller that a certain condition or fault that the controller needs to know about, has occurred. It is in fact a single hardware line that will interrupt the controller and instigate a serial poll to establish which unit triggered the request.

The IEEE-488.2 standard defines the arrangement of registers and enabling registers associated with Service Request, and this will be explained in the following section. The default values for all the "masks" means that no SRQ's will be generated, and you only need to set bits relevant to your application.

7	RQS	ESB	MAV	3	2	1	MD
	6 MSS						

Fig 2.3 The Status Byte

This is the register which controls the generation of the SRQ signal. A SRQ is generated when bit 6, the Master Summary Status bit or MSS is set to 1. A serial poll (SPOLL) will then return the Status Byte, and examination of bit 6, MSS, will show if this device is the one raising the SRQ. The other bits of the status byte indicate the cause of the SRQ. These other 7 bits represent the status of the instrument, and 2 of them are defined by the 488.2 standard, bit 5, the Event Status Bit, ESB, and bit 4 the Message Available, or MAV bit.

The other 5 bits are available for device specific information, in fact in this application only bit 0 is used, the Mode bit or MD bit, which relates to power supply status.

Any of the 7 bits could be enabled so that if it becomes true then a SRQ is generated. The user can set bits in the Service Request Enable Register (SRE), using the **SRE* command, or to examine the contents, **SRE?*. These bits correspond to bits in the Status Byte. When a bit is set in the SRE it enables that bit in the Status Byte to request service. E.g., setting bit 4 in the SRE will cause the device to request service whenever the device has data in the Output Queue.

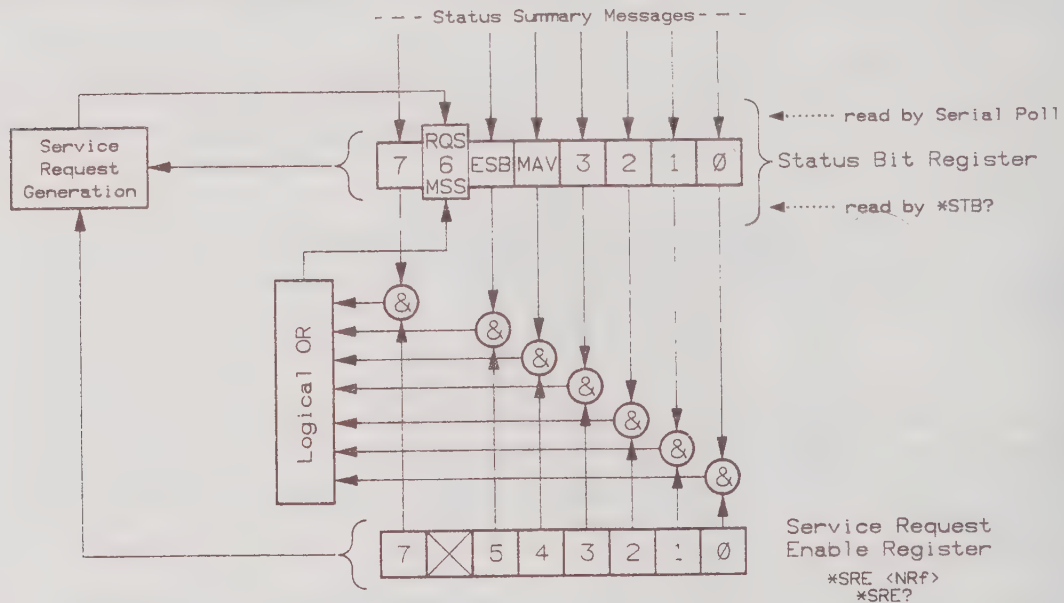


Fig 2.4 Service Request Enabling.

Meaning of the bits in the status register.

As explained above 7 of the bits in the Status Register can be used to generate a SRQ. This register is then normally read by a serial poll, it may also be read at any time using the **STB?* command.

As stated, in this application only 3 bits are used, the defined ESB bit, the MAV bit, and the mode bit, bit 0.

MAV, Bit 4 of the Status Byte.

This bit is set whenever there is data in the output queue or buffer.

ESB, Bit 5 of the Status Byte.

This bit is set whenever a bit is set in another register, the Event Status Register, the ESR, provided also that the corresponding bit is set in the Event Status Enable Register, the ESE. These 2 registers can be read and written to with **ESR?* (read only), for the Event Status and **ESE*, and **ESE?*, for the enabling mask register.

The figure below represents the operation of this Standard Event Status Register (SESR). IEEE488.2 specifies the meaning of each bit in the ESR.

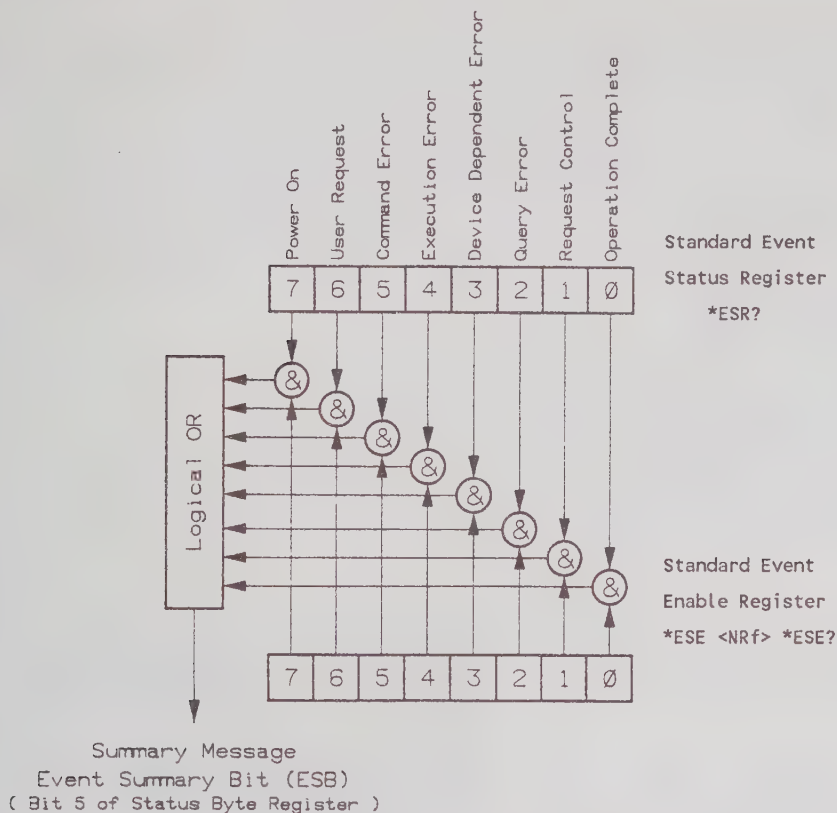


Fig 2.5 Standard Event Status Register

Bit 7-Power On (PON)

This bit indicates that the device's power has been turned off and on since the last time this register was read.

Bit 6-User Request (URQ)

Not applicable.

Bit 5-Command Error (CME)

This bit indicates that the device has detected a command error:

1. An IEEE488.2 syntax error. Message received did not follow 488.2 defined syntax. E.g., it received data that violated the device listening format.
2. The device received an incorrectly spelled or non existent command.

Bit 4-Execution/ Error (EXE)

This bit means that the device detected an error while trying to execute a command:

1. A "programme data" element received in a command was outside the legal range for the device, or inconsistent with the operation of the device.
2. The device could not execute a valid command due to some device condition.

Bit 3-Device-dependent Error (DDE)

This bit indicates that any one (or more) of the flags in the ERROR register are true.

The **Error register** is another register, in which only bit 1 is used.

BIT 1 - INPUT LINE, i.e data link failed, fatal.

The **ERROR** register can be read at any time with **ERR?**. Reading the register clears its contents.

Bit 2-Query Error (QYE)

This bit indicates:

1. An attempt to read data from an empty output queue.
2. Data in output queue lost, e.g. queue overflow.

Bit 1-Request Control (RQC)

Not applicable.

Bit 0-Operation Complete(OPC)

This bit indicates that the device has completed any pending operations and is ready to accept new commands. It is only generated in response to the Operation Complete ***OPC** command.

N.B. The Standard Event Status Register can only be cleared by:

1. A Clear Command ***CLR**
2. Reading the register ***ESR?**
3. Power on.

Mode Bit of status byte. Bit 0.

This bit is set if any one of the bits in the **MODE** register, i.e power supply operating mode, goes high, and the corresponding bit in the Mode Enable register is set, and only then if this condition persists for longer than the SRQ delay value.

This allows transient conditions to be "filtered" out from generating Service Requests. However the latching conditions bypass this delay: OT and OV will, if unmasked, generate a flag in the Status Byte instantly whatever the value of delay.

MODE register read	- MDn?
Mode Enable write	- MDEn
Mode Enable read	- MDEn?
SRQ Delay, write	- DLYn
SRQ Delay, read	- DLYn?

2.4.8 Other commands.

VSET? ISET? VOUT? IOUT? OVSET? OUT?
AMD? *OPC? *TST? *IDN? ROM? *RST WAI
QCLR LCL BLP DCL ZERO SCLR LCK ULCK

VSETn? ISETn? OVSETn? OUTn? all put the value of the programmed parameter in the output queue.

VOUTn? IOUTn? Puts the measured output parameter into the output queue.

AMDn? puts the value of the accumulated mode register in the output queue. Whenever the MODE register CHANGES, a 1 is set in the corresponding bit of this register. this can be of use in determining status history. It is reset by the *CLS, clear status register command.

*OPC? puts a 1 in the output queue when pending operations are complete.

*TST? performs a self test and puts the error register value, as would be done by ERR? in the output queue, 0 = pass.

*IDN? puts the unit identification code in the output queue, this is of the form:

"FARNELL,<name>,0,<ver>" (with quotes)

Where: <name> is the model type e.g. 'PDD3010'.
<ver> is the firmware revision e.g. '1.2'

ROM? puts the date of the last software revision in the output queue:

"dd/mm/yy"

e.g. "25/12/92"

*RST this command resets the power supply to the power on state, the GPIB command DC or Device Clear has a similar effect. See section 2.4.9 for all the power on conditions.

WAI causes the power supply to wait for a given time, the time value is in seconds, with a 10ms minimum, as for DLY, the Service Request delay. Note that these times are approximate.

QCLR clears the output queue.

LCL returns unit to local operation in a similar manner to the GPIB GTL or Go To Local command.

BLP sounds the units on board buzzer.

DCL sets the power supply to conditions stored in store 0. This is the same as imposing a GPIB 'device clear'.

ZERO sets all the operating variables to the default values see section 2.4.9.

SCLR sets all operating variables to the default values and then clears all the stores.

LCK LCK? Controls the total lock-out function. These can override the position of the lockout switch. Setting this to '1' causes the unit to totally lock-out the front panel. Setting to 0 will permit local operation subject to the condition of the bus and the use of the Go To Local switch.

2.4.9 Default Settings

Store 0 is implemented at power on, these have various default values when shipped. They can be changed as required to give any desired set-up at switch on.

In the event of battery/RAM failure resulting in data corruption being detected then store 0 will be reset to these default values. This fault will of course be signalled in the ERROR register.

Parameter	Default
Voltage	0
Current	0
Over Voltage	Vmaximum
Enable	0 or OFF
SRQ Delay	10mS
Service Request Enable	0 All bits disabled
Event Status Enable	0 All bits disabled
Mode Register Enable	0 All bits disabled
Operation Complete	0 not active
Local	LOCAL operation. *

* - Subject to the position of the LOCK-OUT switch

3. CALIBRATION PROCEDURE

The following calibration process should be carried out after the power supply has been calibrated.

3.1 Equipment Required

- a) Digital Voltmeter: Capable of reading up to the maximum power supply output voltage with 5 digits resolution and accuracy better than 0.01%. A suitable instrument is the Solatron 7150 Digital Multimeter.
- b) Current shunt: Capable of carrying the maximum power supply output current, calibrated to an accuracy of better than 0.2%. This may be used in conjunction with a multimeter of similar accuracy and resolution to that above.
- c) Load: A passive or active load capable of handling the maximum voltage, current and power capability of the power supply.
- d) GPIB controller: Capable of transmitting and receiving data via the GPIB bus.

3.2 Preparation

Remove the covers from the power supply. All the calibration pots are found on the DAC boards which are plugged into the power supply main board.

Connect the P unit to the GPIB controller and set the rear address switches to the GPIB address value appropriate for the controller.

Turn the DAC board 'OVL Adjust' preset (P3) fully clockwise.

3.3 Program Voltage Calibration

Connect the voltmeter across the output terminals of the AP or MP unit at the same point as the sense links.

Programme the voltage to maximum rated, and the current limit to 2A.

To do this transmit strings to the unit with the format:

e.g 60V unit: "VSET 60"

2A current limit: "ISET 2"

or: "VSET 60;ISET 2"

for different resolution, e.g 34.56v: "VSET 34.56"

To enable the unit: "OUT 1" ,To disable: "OUT 0"

Enable the unit.

The the annunciators should indicate constant voltage mode. Turn the 'Volts Adjust' preset (P1) on the DAC board to set the output to its programmed value $\pm 0.01\%$.

3.4 Voltage Readback Calibration

i) Program the output to its maximum rated voltage and set the GPIB controller to readback mode.

To readback, first transmit "VOUT?" for volts or "IOUT?" for amps, then when the GPIB controller reads from the unit it will return the appropriate value. This can done repetitively for ease of setting up the readback adjustments.

Turn the 'Volts read adjust' preset (P4) until the voltage displayed on the controller equals the output (programmed) voltage ± 1 least significant digit.

ii) Program the output to 10% of the maximum rated voltage, and again set the GPIB controller to readback mode. Turn the 'Volts read offset' preset (P6) until the voltage displayed on the controller equals the output (programmed) voltage ± 1 least significant digit.

Repeat steps (i) and (ii) until no further adjustment is required.

iii) Check the status of the power supply. Do this by first transmitting the command: "MD?"

Readback the status string from the power supply. This can be decoded as follows:

- 1 = Constant voltage (CV)
- 2 = Constant current (CI)
- 32 = Unregulated (UNREG)
- 8 = Overvoltage trip (OVT)
- 16 = Overtemperature trip (OT)
- 4 = Sink mode (SNK)

In this test the status should be CV. (1)

3.5 Over Voltage Trip Calibration

*To programme the overvoltage trip value, e.g to set it to 60v transmit the string
"OVSET 60" "OVSET 60"*

Set the over voltage trip to 1% below the maximum rated output voltage, e.g 59.4v for 60v unit and set the output voltage to the maximum rated output voltage. Carefully turn the 'OVL Adjust' preset (P3) anticlockwise until the overvoltage trip operates - When this occurs, the bus card emits an audible warning, the output voltage collapses, and the P unit front panel annunciator 'OVL' lamp is asserted. Disable the unit, and reprogramme the overvoltage trip to its maximum value (Around 2-3V above the nominal rated output voltage).

3.6 Program Current Calibration

Connect the load up to the output, with the current shunt connected into the negative line. The voltmeter should be connected directly across the shunt. Refit terminal guard.

Using the GPIB controller, program the current to 70% of its maximum rated value, and the voltage to approximately 25% of its rated value, and enable the unit. Adjust the load until the front panel 'CV' annunciator extinguishes, and the 'CI' annunciator illuminates (ie the supply is operating in constant current mode). Turn the 'Amps adjust' preset (P2) on the DAC board until the output current equals the programmed value $\pm 0.01\%$. Allow the unit to run under this load condition for 20 minutes, then readjust.

3.7 Current Readback Calibration

Without allowing the unit to cool:-

//

i) Program the current to 70% of its maximum rated value, and adjust the load to allow the supply to run in constant current mode. Set the GPIB controller to readback mode, as in 2.4(i). Turn the 'Amps read adjust' preset (P5) on the DAC board until the readback current equals the output (programmed) value ± 1 least significant digit.

ii) Program the current to 10% of its maximum rated value, and adjust the load for constant current operation. Set the GPIB controller to readback mode. Turn the 'Amps read offset' preset (P7) on the DAC board until the readback current equals the output (programmed) value ± 1 least significant digit.

Repeat steps (i) and (ii) until no further adjustment is required. Check the status of the unit, as in 3.4, and that it indicates that the power supply is operating in constant current mode.

3.8 Functional Check

3.8.1 Regulation

With the P unit under GPIB bus control, carry out the load regulation check. Ensure that these are still within the specification.

3.8.2 Programming Accuracy

The following tests should be carried out with no load connected, ie constant voltage mode, and the voltmeter connected directly across the output.

Program the current to 10% of its maximum value, then program the voltage to 20%, 50%, and 80% of its full scale value. In each case, ensure that the output is within the following specification:-

0.1% of output $\pm$ 0.07% of full scale.

The following tests should be carried out with a suitable shunt connected directly across the output, ie in constant current mode, with a voltmeter directly across the shunt.

Program the voltage to 10% of its maximum value, then program the current to 20%, 50% and 80% of its full scale value. In each case, ensure that the output current is within the following specification:-

0.55% of output $\pm$ 0.07% of full scale.

4. MAINTENANCE

4.1 Guarantee

The equipment supplied by Farnell Instruments Limited is guaranteed against defective material and faulty manufacture for a period of twelve months from the date of despatch. In the case of material or components employed in the equipment but not manufactured by us, we allow the customer the period of any guarantee extended to us.

The equipment has been carefully inspected and submitted to comprehensive tests at the factory prior to despatch. If, within the guarantee period, any defect is discovered in the equipment in respect of material or workmanship and reasonably within our control, we undertake to make good the defect at our own expense subject to our standard conditions of sale. In exceptional circumstances and at the discretion of the Service Manager, a charge for labour and carriage costs incurred may be made.

Our responsibility is in all cases limited to the cost of making good the defect in the equipment itself. The guarantee does not extend to third parties, nor does it apply to defects caused by abnormal conditions of working, accident, misuse, neglect or wear and tear.

4.2 Service

In the event of difficulty, or apparent circuit malfunction, it is advisable to telephone (or telex) the Service Department or your local Sales Engineer or Agent (if overseas) for advice before attempting repairs.

For repairs and maintenance it is recommended that the complete instrument be returned to:

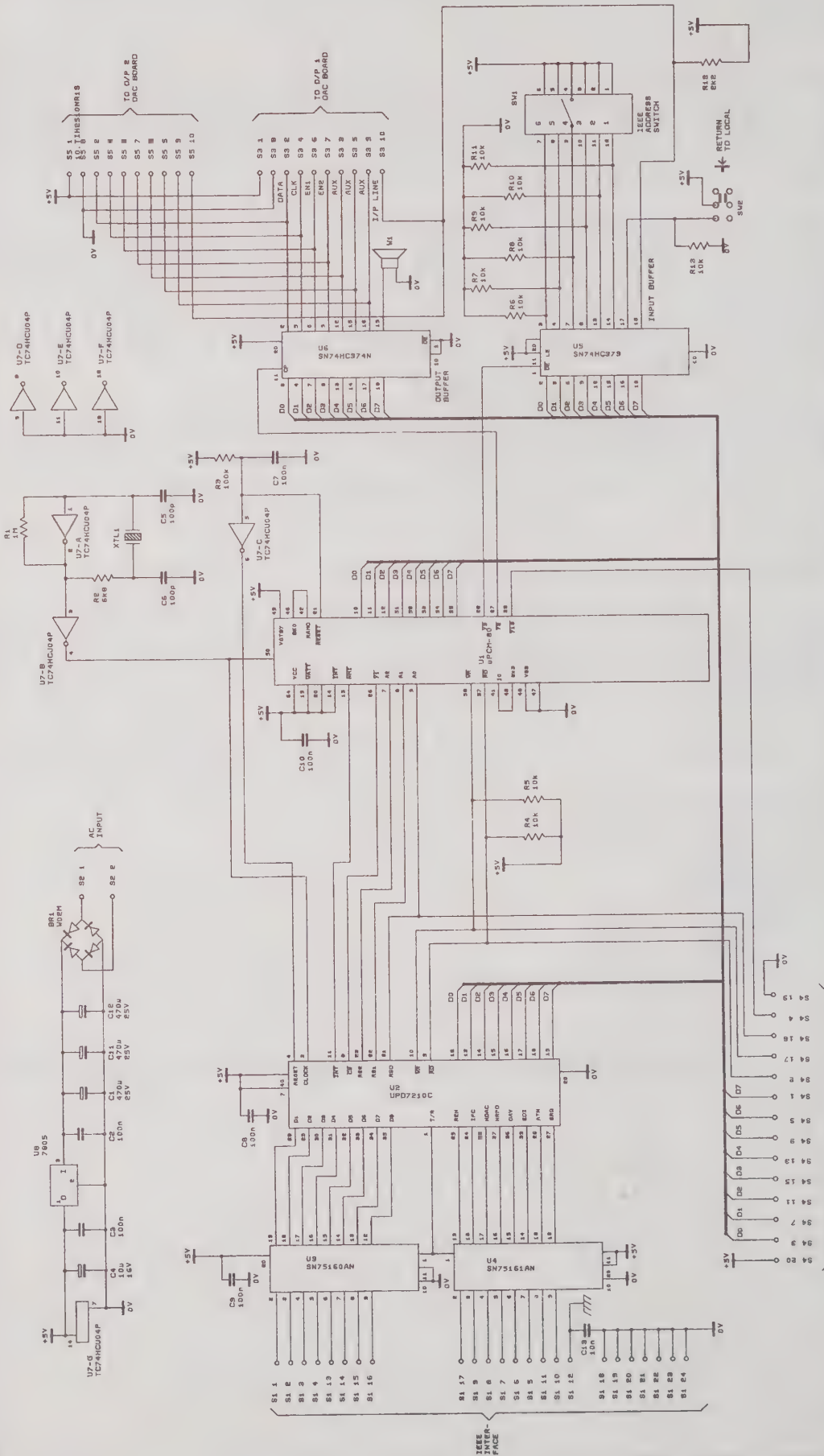
The Service Department,
Farnell Instruments Limited,
Osborn House,
Sandbeck Way,
Wetherby,
West Yorkshire.
LS22 4DN

Tel. (0937) 581961 Fax (0937) 586907 Telex 557294

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Please ensure adequate care is taken with packing and arrange insurance cover against transit damage or loss.

5. CIRCUIT DIAGRAMS



 FARNELL INSTRUMENTS LTD. . SANDBECK WAY, WETHERBY, YORKS. LS22 4DH	DRAWING NO. 2SZX0754	
	P-BUS CONTROLLER	SHEET OF SHEETS

NOTES:
ALL CAPACITOR VALUES IN P.
ALL RESISTOR VALUES IN OHMS.
UNLESS OTHERWISE STATED

NO 07351

10

100

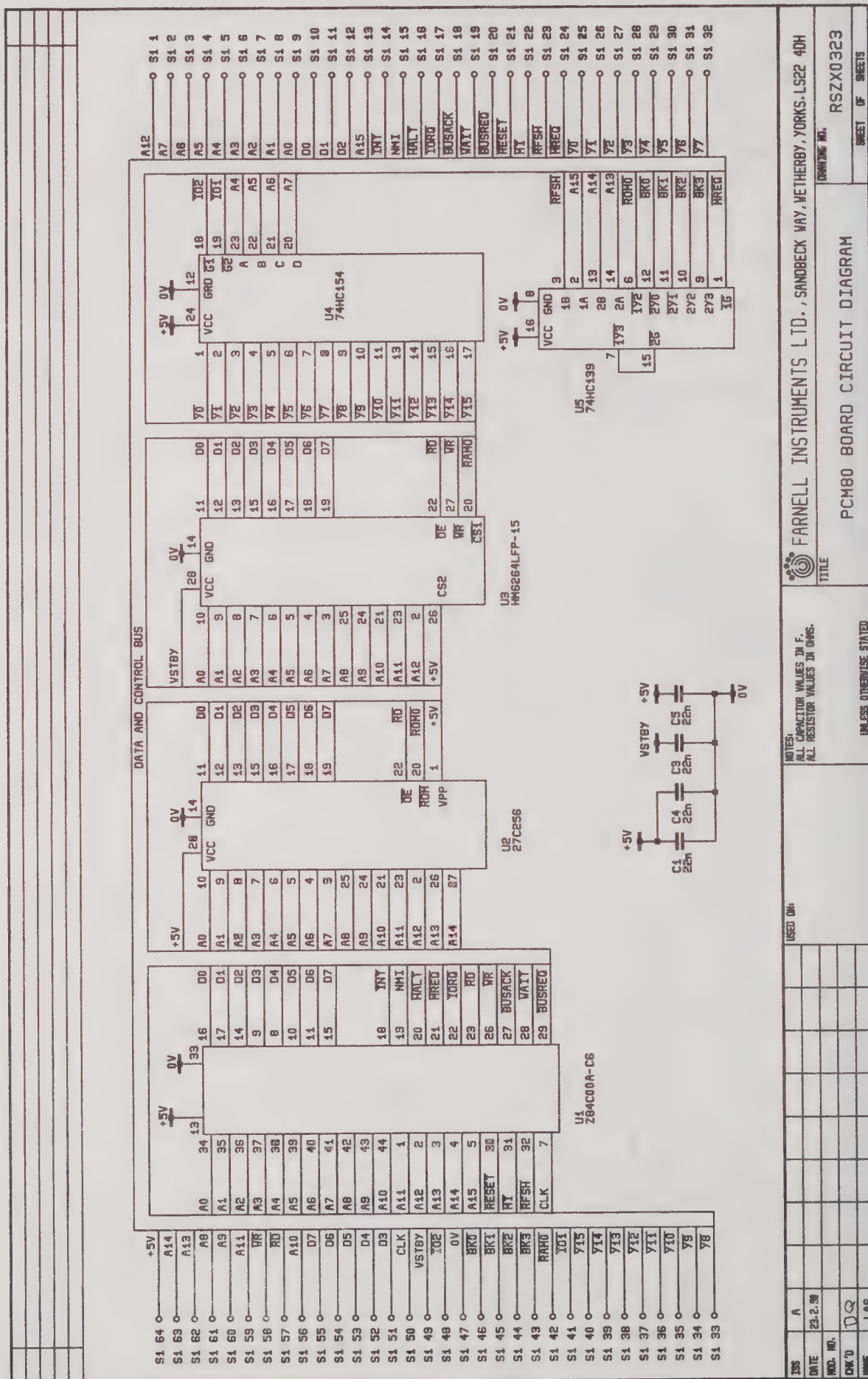
1

1

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2	1/7/	-	P	15
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6.COMPONENT SCHEDULES

Date: 24/8/93

Unit Item No: 1EAPIEEE

Description: IEEE 488 INTERFACE OPTION

Important explanation - Please read before ordering parts.

Due to limitations in the number of character spaces available the information in the circuit reference field has been abbreviated and the following notes are provided as a guide to its interpretation.

1. Where a component is used more than once on an assembly the alphabetic portion of the circuit reference for its second and subsequent locations has been omitted; eg. the circuit reference information for a component located at R1 and R6 will appear as: R1 6

2. The circuit reference numbers are presented in ascending decade blocks delimited by colons; second and subsequent numbers within a decade block represent only the unit value of the location (the tens and hundreds values being implied); eg. for a component located at R54, R57, R59, R82, R82, R87, R102, R110 and R112 the circuit reference entry will be: R54 7 9:82 7 9:82 7:102:10 2.

3. Where components are used in a series of neighbouring circuit reference locations the circuit reference numbers are represented as inclusive blocks using a hyphen; eg. for a component located at R16, R19, R21, R24, R25, R26, R31, R37, R38, R39, R40, R44, and R46 will be represented as R16 9:21 4-6: 31 37-40 4 6 (An exception to the rules occurs when a series crosses a decade block in which case the tens value is inserted.

4. Comments are preceded by a semicolon.

When ordering replacement parts please be sure to quote the part number provided.

FARNELL PART NUMBER	DESCRIPTION	MANF PART NO	ISS	QTY	COMPONENT REFERENCE
2EAPIEEE	IEEE 488 INTERFACE OPTION			1.00	
5NPCRB	BUS CONTROLLER BD ASM.		P1	1.00	
5NPCM80	PCM80 ASSY		A	1.00	
5UPCM80	PCM80 ASSY		A	1.00	SMD
8ZX0323	PCM80	RSZX0323	A	1.00	
UBC1195	PCM80 CIRCUIT BOARD	S7NCT11950	B	1.00	
UCC5220KA0KX	22NF 10% 50V 1206 X7R	1206Y223KXAT		4.00	C1-4
UIDP474HC139	IC 74HC139 SO-14#STATIC#	CD74HC139M		1.00	U5
UIDP474HC154	/74HC154 SO-24 #STATIC#K	MM74HC154WM		1.00	U4
VD4464	SRAM 8KX8 150NS CMOS STATIC	TC5564AFL15		1.00	U3
VD84C0006	MICRO 8-BIT Z80 6MHZ STATIC	Z84C0006VEC		1.00	U1
8P1020401	PCM80 CB ASSY		A	1.00	
HE3000	LEAD FRAME BA3000/040	BA3000/040		64.00	
VS28C	28W CARRIER 612-92-628	612-93-628		1.00	
BC1717	BUS CONTROLLER PCB.	BC17170	A	1.00	B
CC3100PLG	100PF 2% 100V N150	RP050 683+34101		2.00	C5 6
CEB10U0JM1	10UF 20% 50V	KMVB		1.00	C4
CEC470UGM	470UF 20% 25V	R050 KMVB		3.00	C1:11 2
CR6100NKM	100NF 20% 63V	R050 MKS2M1N		6.00	C2 3 7-10

Unit Item No: 1EAPIEEE

Description: IEEE 488 INTERFACE OPTION

FARNELL PART NUMBER	DESCRIPTION	MANF PART NO	ISS	QTY	COMPONENT REFERENCE
DBW02M	BRIDGE RECTIFIER	W02G		1.00	BR1
EA889	BUZZER (STK NO. 09984H)	889-1521A		1.00	W1
HSTV5	HEATSINK TV5	HSTV5		1.00	U8
RM42K20FF	2K20 1% 0W60 50PPM 250V	MRS25		1.00	R12
RM46K80FF	6K80 1% 0W60 50PPM 250V	MRS25		1.00	R2
RM510K0FF	10K0 1% 0W60 50PPM 250V	MRS25		9.00	R4-11 3
RM6100KFF	100K 1% 0W60 50PPM 250V	MRS25		1.00	R3
RM71M00FF	1M00 1% 0W60 50PPM 250V	MRS25		1.00	R1
SB0059	AP60/50	4ST000059	B	1.00	SW2
SS6023	DIL SLIDE SWITCH 6WAY C/O	SDES6-023		1.00	SW1
TBA2520PD	PIN HEADR DOUB ROW 2 X 10 WAY	1-826925-0		1.00	S4
TBA3902PR	2W PIN WAFER 90DEG WITH LOCK	640389-2		1.00	S2
TIH2510NR1S	10 WAY PIN HEADER RT ANGLE	ID101-H10-K-06-E1		2.00	S3 5
TK57L24	CONNECT RT ANGLE CB 24 CONTACT	57L-2024027C0D35		1.00	S1
VA7805CT	REGULATOR	LM7805CT/LM340T5		1.00	U8
VD27C256	EPROM 32KX8 250NS 28-D STATIC	TM527C25625JL		1.00	U102
VD7210C	GPIB UNIVERSAL INTERFACE	UPD7210C		1.00	U2
VD74HC373	HCMOS OCTAL D-TYP T-LACH STATI	MC74HC373N		1.00	U5
VD74HC374N	HCMOS OCTAL D-TYPE F-F STATIC	74HC374N		1.00	U6
VD74HCU04	CMOS HI-SPD HEX INV NOBUF STAT	MM74HCU04N		1.00	U7
VD160AN	INT BUS GEN PPSE	SN75160AN-BN		1.00	U3
VD75161AN	INT BUS GEN PPSE	SN75161BN		1.00	U4
VR400MG	RESONATOR CSA400MG	CSA400MG		1.00	XTL1
VS14L	IC SKT 14WAY	703-3314-01-04-10		1.00	U7
VS20L	IC SKT 20 WAY	703-3320-01-04-10		4.00	U3-6
5NPSDIB	INTERFACE CB. ASM.		P1	1.00	
5UPSDIB	INTERFACE CB. ASM. "SMD COMPS"		P1	1.00	
UBC1937	P SERIES INTERFACE PCB	UBC19370	A	1.00	B
UCC4100KAONX	1NF 10% 100V 1206 X7R	1206Y102KXBT		8.00	C3 7:10-12:23-25
UCC6100KAOKX	0U1F 10% 50V 1206 X7R	1206Y104KXAT		11.00	C1 2 4 5 8 9:13 4 7 9:21
UCC6220MA2KX	U22UF 20% 2220 X7R SP	2220Y224MFAT		3.00	C6:15 6
UDGC0LL4148	LL4148 MINI-MELF	LL4148		2.00	D1 2
UIDP40106BT	HEF40106BT SO-14	HEF40106BT		1.00	U7
UIDP4094BT	HEF4094BT SO-14	HEF4094BT		2.00	U5 6
UIDP44051	SMD IC 4051 SO PACKAGE	HEF4051BT		1.00	U8
URM2470GA0	47R 2% 1206	RC-01		3.00	R25-27
URM3680GA0	680R 2% 1206	RC-01		3.00	R6 8:10
URM3820GA0	820R 2% 1206	RC-01		3.00	R1-3
URM4100GA0	1K0R 2% 1206	RC-01		1.00	R11
URM4120GA0	1K2R 2% 1206	RC-01		1.00	R4
URM4220GA0	2K2R 2% 1206	RC-01		1.00	R13
URM4240GA0	2K4R 2% 1206	RC-01		2.00	R14 7
URM4270GA0	2K7R 2% 1206	RC-01		2.00	R15 8
URM4360GA0	3K6R 2% 1206	RC-01		1.00	R33
URM4560GA0	5K6R 2% 1206	RC-01		3.00	R5 7 9
URM4680GA0	6K8R 2% 1206	RC-01		1.00	R32
URM5100GA0	10KR 2% 1206	RC-01		4.00	R12 6:30 1
URM5470GA0	47KR 2% 1206	RC-01		2.00	R28 9
UTNP0LGP	SOT23#45V#A80#100G#180F(0143)	BCW66-G/H(3SC0143)	A	4.00	Q1-4
CR510NOSM	10NF 20% 400V	R100 368-51103		1.00	C22
CTB10U0EM	10UF 20% 16V	R050 TAG-16		2.00	C18:20

Unit Item No: 1EAPIEEE

Description: IEEE 488 INTERFACE OPTION

FARNELL PART NUMBER	DESCRIPTION	MANF PART NO	ISS	QTY	COMPONENT REFERENCE
DZ12V45C1	2.45 1.43% 0W30	ZN458B		1.00	Z1
HC0161	CABLE ASSY	4SC000161	A	1.00	S1
PM3500RKH	500R 10% PRESET HORZ STURN	63X		2.00	P1 3
PM41K00KH	1K00 10% PRESET HORZ STURN	63X		1.00	P4
PM42K00KH1	2K00 10% PRESET HORZ STURN	63X		1.00	P2
PM45K00KH1	5K00 10% PRESET HORZ STURN	63X		1.00	P5
PM510K0KH2	10K0 10% PRESET HORZ STURN	63X		2.00	P6 7
RLINK22	22 SWG TC LINK	RLINK22		2.00	LK1 2
RM41K50FF	1K50 1% 0W60 50PPM 250V	MRS25		1.00	R37
RM42K20FF	2K20 1% 0W60 50PPM 250V	MRS25		1.00	R36
RM43K90FF	3K90 1% 0W60 50PPM 250V	MRS25		2.00	R21 2
RM44K42FF	4K42 1% 0W60 50PPM 250V	MRS25		2.00	R20 4
RM46K20FF	6K20 1% 0W60 50PPM 250V	MRS25		2.00	R19:23
RM49K10FF	9K10 1% 0W60 50PPM 250V	MRS25		1.00	R34
RM510K0FF	10K0 1% 0W60 50PPM 250V	MRS25		1.00	R35
TBA2510HD	CONECTR DOUB ROW 2 X 5 WAY	167271-5		1.00	S3
TBA2512HD	CONECTR DOUB ROW 2 X 6 WAY	167271-6		1.00	S2
VA17AQ	OPTO COUP HFE SEL CTR 45-90	3SC0139	C	4.00	U1-4
VA3140E	OP AMP SINGLE	STATIC CA3140E		2.00	U12 3
VA400FY	OP AMP	OP400FY		1.00	U11
VD7549JN	DAC 12BIT UP 1LSB 20DIP	AD7549JN		2.00	U9:10
VS14L	IC SKT 14WAY	703-3314-01-04-10		1.00	U11
VS20L	IC SKT 20 WAY	703-3320-01-04-10		2.00	U9:10
VS6L	IC SKT 6WAY	703-3306-01-04-10		4.00	U1-4
VS8P	IC SKT 8WAY	703-3308-01-04-10		2.00	U12 3
9HPBUS	IEEE488 INTERFACE OPT HANDBOOK			1.00	



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